

INTERNATIONAL A-LEVEL PHYSICS

(PH03) Fields and their consequences Report on the examination

June 2019

REPORT ON EXAMINATION: INTERNATIONAL A-LEVEL PHYSICS (PH03) FIELDS AND THEIR CONSEQUENCES – JUNE 2019

This was the third examination of this unit. There was a broad range of marks, with comparable overall performances in Sections A and B. There was no firm indication of lack of time, although a large proportion of students did not attempt the final question in Section A. Students did particularly well on the questions (apart from 3.5 and 3.6) assessing electric fields and capacitance.

'Show that' questions, directing students to derive algebraic expressions, were mostly handled well. In these, students are advised to show clear working out and to quote final values to more significant figures than given in the question. For some explanations, students helped their written answers by quoting relevant equations. This strategy could have been usefully employed in other questions too.

SECTION A

QUESTION 01

- 1.1 Nearly all students achieved some credit in this question. Students who only gained 1 mark failed to start their derivation with the general equation.
- 1.2 This question was answered well. Over 65% of students gained full marks.
- 1.3 This question discriminated well. About 40% of students achieved full marks. There was some evidence of students using the equation (from 1.1) for *v* as the potential energy *V*. Students would have been better to show their working here.
- 1.4 Many students achieved one mark on this question by stating what would happen to one of the energies, but only about 20% could explain the relative change of both. This question required an explanation. This could have been supported by equations but quoting these, on their own, was not sufficient.

QUESTION 02

- 2.1 Just over 60% of students answered this question. Students are reminded that they need to quote a final value to more significant figures than given in all 'show that' questions.
- 2.2 This question was not answered well. Many students had little understanding of the concept of angular speed and failed to make a connection with the previous question. 'Show that' questions often provide information necessary for subsequent parts.
- 2.3 Just over one quarter of students gave a relevant reason why results could not be recorded in this experiment.
- 2.4 This question discriminated well with almost all students providing some answer. Students who gained only partial credit often expressed ideas poorly. A reference to Lenz's law had to relate to the idea of a resistive force.

QUESTION 03

- 3.1 Nearly 75% of students achieved full credit in this question. Many responses were excellent.
- 3.2 Almost all students answered this question with some creditworthy response. Students who gained only one mark failed to give an answer to more than one significant figure.

- 3.3 This question was answered well by a large majority of students and some very clear derivations were seen.
- 3.4 Over 80% of students achieved full credit in this question.
- 3.5 Only about 15% of students stated two properties of a dielectric material. Those who only gained one mark often referred only to the ability of the material to be polarised.
- 3.6 This question proved challenging to students, with only about 35% gaining any marks. Students were more likely to give accurate answers when they used equations to deduce how an increase in the relative permittivity would affect the potential difference.

QUESTION 04

4.1 About 60% of students answered this question correctly. Examiners did not interpret "*down*" as meaning "*into the plane of the paper*"; students should appreciate the need for accuracy in their technical language.

4.2 Most students could correctly explain that the proton's speed increases. About 25% gave a reason in terms of a force or work done.

4.3 Students were more successful at this explanation than 4.2. Nearly 40% of students gained full credit by explaining the origin and effect of the centripetal force.

4.4 This derivation question was very well answered with over 80% of the cohort gaining full marks.

4.5 About half of the cohort dealt successfully with the conversion of MeV to J and achieved full credit. A large number of students incorrectly re-arranged the equation and should substitute in the values before attempting to change the subject. Common mistakes were to use the specific charge of the proton (for q) or the electron mass (for m).

QUESTION 05

5.1 A large majority of students gained three or four marks in this question. Several methods were valid, but it was not always clear which one was being used by the student. Full marks were awarded to students only if their mathematics was completely correct.

5.2 This question was answered well. A clear method was evident in many answers. Interestingly, students were more likely in this question (than in other 'show that' questions) to give an answer to more than one significant figure.

5.3 This question discriminated reasonably well, but about a quarter of students made no attempt at it. The unit mark was awarded if a valid method was attempted or used.

SECTION B

Students were particularly successful at questions 7,8, 10, 11, 12, 14, 18, 19, 20, 21, 24 and 26.

Students found questions 9, 15, 25, 28 and 30 particularly difficult.

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